

# TEST REPORT

**Applicant:** Autel Robotics Co., Ltd.  
**Address of Applicant:** 601,701,801,901, Block B1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China  
**Manufacturer:** Autel Robotics Co., Ltd.  
**Address of Manufacturer:** 601,701,801,901, Block B1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China  
**Factory:** Autel Robotics Co., Ltd. Guangming Branch  
**Address of Factory:** No.701, Jixie Factory, Building 4, Yanxiang Technology Industrial Park, Gaoxin Road, Dongzhou Community, Guangming district, Shenzhen, Guangdong, China  
**Equipment Under Test (EUT)**  
**Product Name:** Nest  
**Model No.:** Nest  
**Trade Mark:** Autel Robotics  
Article 2, Paragraph 1, Item 19  
**Applicable standards:** MIC Notice No.88 Annex 1  
MIC Notice No.88 Annex 43  
**Date of sample receipt:** Jun.18,2023  
**Date of Test:** Jun.18-Nov.21,2023  
**Date of report issued:** Nov.22,2023  
**Test Result :** PASS \*

\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



David Zhong

Laboratory Manager

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## 2 Version

Version No.	Date	Description
00	Nov.22,2023	Original

**Prepared By:**

**Date:**

Nov.22,2023

**Project Engineer**

**Check By:**

**Date:**

Nov.22,2023

**Reviewer**



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## 4 Test Summary

Test Item	Result
RF shielding method	Pass
Frequency Error	Pass
Antenna Power	Pass
99% Occupied bandwidth	Pass
Spread spectrum bandwidth	Pass
Spurious Emissions Intensity	Pass
Secondary radiated emissions	Pass
Interference suppression	Pass
Carrier Sense Capability	N/A
Number of carrier	Pass <sup>Note 1,2</sup>
Spreading factor	Pass

**Notes:**

1. This device has more than 1 subcarrier in 1MHz, compliances with the requirement.

## 5 General Information

### 5.1 General Description of EUT

Product Name:	Nest
Model No.:	Nest
Hardware Version:	N/A
Software Version:	N/A
Operation Frequency:	2403.5MHz~2475.5MHz
Channel Numbers:	1.4MHz: 73channels, 10MHz: 65channels, 20MHz: 51channels
Channel Separation:	1MHz
Modulation Type:	QPSK, 16QAM
Rated Power:	<p>Fibre-glass epoxy antenna</p> <p>1.4MHz:QPSK: 5.1mW/MHz, 16QAM: 4.9mW/MHz for MIMO</p> <p>10MHz: QPSK: 5.1mW/MHz, 16QAM: 5.2mW/MHz for MIMO</p> <p>20MHz: QPSK: 5.1mW/MHz, 16QAM: 5.1mW/MHz for MIMO</p> <p>Integral antenna</p> <p>1.4MHz:QPSK: 6.9mW/MHz, 16QAM: 6.6mW/MHz for MIMO</p> <p>10MHz: QPSK: 7.0mW/MHz, 16QAM: 7.0mW/MHz for MIMO</p> <p>20MHz: QPSK: 6.9mW/MHz, 16QAM: 6.0mW/MHz for MIMO</p>
Antenna Type:	External antenna&Integral antenna
Antenna Gain:	<p>2.4G transfer image</p> <p>Fibre-glass epoxy antenna:</p> <p>ANT1: 5dBi &amp; ANT2: 5dBi</p> <p>Integral antenna :</p> <p>ANT1: 3.3dBi &amp; ANT2: 2.4dBi</p>
Power supply:	DC 12V



## 1.4MHz: 73channels

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2403.5	36	2439.5
2	2404.5	.....	.....
.....	.....	.....	.....
.....	.....	72	2474.5
35	2438.5	73	2475.5

## 10MHz: 65channels

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2407.5	33	2439.5
2	2408.5	.....	.....
.....	.....	.....	.....
.....	.....	64	2470.5
32	2438.5	65	2471.5

## 10MHz:515channels

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	2412.5	33	2437.5
2	2413.5	.....	.....
.....	.....	.....	.....
.....	.....	50	2461.5
25	2436.5	51	2462.5

## Test Frequency

Bandwidth	Frequency(MHz)		
	Lowest channel	Middle channel	Highest channel
1.4MHz	2403.5	2439.5	2475.5
10MHz	2407.5	2439.5	2471.5
20MHz	2412.5	2439.5	2462.5



## 5.2 Test mode

Software is used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

## 5.3 Test condition

Note: The EUT has its own voltage regulator principle from P5016HGQH, the output voltage of the chip is 3.3V and the fluctuation of power supply to the RF circuit of EUT is equal to or less than +/- 1%. So exempt extremely high and low supply voltage condition tests, EUT only operated in normal voltage to test all regulations.

External power supply	RF IC power supply	Deviation from normal	Deviation
DC12.0V	3.3V	-	-
Temperature:	25 °C		
Humidity:	52%		
Atmospheric Pressure	1010mbar		

## 5.4 Test Facility

## 5.5 Test Location

All tests were performed at:

Shenzhen CST Technology Service Co., Ltd.

Room 110, Floor 1st, Building D, Baoan Zhigu Technology Park, Xixiang Street, Baoan District, Shenzhen, China. 518000

Telephone: +86 (0) 755 2779 7627

## 5.6 Other Information Requested by the Customer

None.

## 5.7 Test Instruments list

Radio conducted test:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Radio Test Software	TST	V2	CST210	Oct. 15, 2023	Oct. 14, 2024
2	TST PASS RF control box V2	TST	V2	CST210	Oct. 15, 2023	Oct. 14, 2024
3	Power measuring unit	TST	V2	CST210	Oct. 15, 2023	Oct. 14, 2024
4	Automatic path switching module	TST	V2	CST210	Oct. 15, 2023	Oct. 14, 2024
5	Spectrum Analyzer	Agilent	N9020A	CST001	Oct. 15, 2023	Oct. 14, 2024
6	Signal Generator	Agilent	N5182A	CST211	Oct. 15, 2023	Oct. 14, 2024
7	Signal Generator	Agilent	N5181A	CST212	Oct. 15, 2023	Oct. 14, 2024
8	UNIVERSAL RADIO COMMUNICATION TESTER	Rohde & Schwarz	CMW200	CST002	Oct. 15, 2023	Oct. 14, 2024
9	Splitter	Agilent	11636B	CST213	Oct. 15, 2023	Oct. 14, 2024
10	Power Attenuator	BTI	30dB/250W	CST216	Oct. 15, 2023	Oct. 14, 2024
11	Power Attenuator	BTI	20dB	CST217	Oct. 15, 2023	Oct. 14, 2024
12	D.C. Power Supply	Gwinstek	GPC-3060D	CST018	Oct. 15, 2023	Oct. 14, 2024
13	Coaxial Cable	CST	N/A	CST219	Oct. 15, 2023	Oct. 14, 2024
14	Coaxial Cable	CST	N/A	CST220	Oct. 15, 2023	Oct. 14, 2024
15	Coaxial cable	CST	N/A	CST222	Oct. 15, 2023	Oct. 14, 2024
16	Coaxial Cable	CST	N/A	CST223	Oct. 15, 2023	Oct. 14, 2024
17	Temperature and humidity box	ATOINSTRUMENT	ATH-2254-CP	CST026	Oct. 15, 2023	Oct. 14, 2024
18	Temperature and humidity meter	GEMLEAD	STH130	CST042	Oct. 15, 2023	Oct. 14, 2024
19	Digital oscilloscope	Tektronix	TDS3032B	CST045	Oct. 15, 2023	Oct. 14, 2024

Remark: all above equipments were calibrated by CEPREI calibration and testing center.

## 5.8 Measurement uncertainty

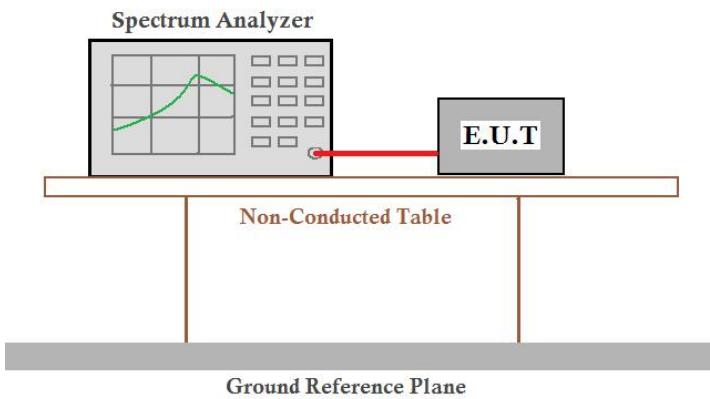
For the test methods, according to the present document, the measurement uncertainty figures shall be calculated in accordance with TR100028-1 [2] and shall correspond to an expansion factor (coverage factor)  $K=1.96$  or  $K=2$  (which provide confidence levels of respectively 95% and 95.5% in the case where the distributions characterizing the actual measurement uncertainties are normal).

Parameter	Uncertainty
RF frequency	$\pm 6 \times 10^{-7}$
Total RF power, conducted	$\pm 0.8\text{dB}$
Spurious emissions, conducted	$\pm 0.8\text{dB}$
DC and low frequency voltages	$\pm 3\%$
Humidity	$\pm 5\%$
Temperature	$\pm 1^\circ\text{C}$



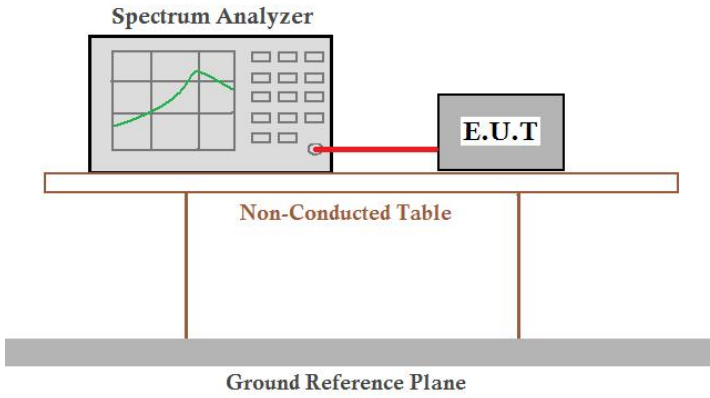
## 6 Test results and Measurement Data

### 6.1 Frequency Error

Test condition:	Without modulation, continuously transmitting.
Spectrum set:	Test Frequency: test channel, RBW=VBW=10KHz, Span=1MHz, Sweep time=Auto, Detector mode=Positive peak
Limit:	$\pm 50\text{ppm}$
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test results:	Pass

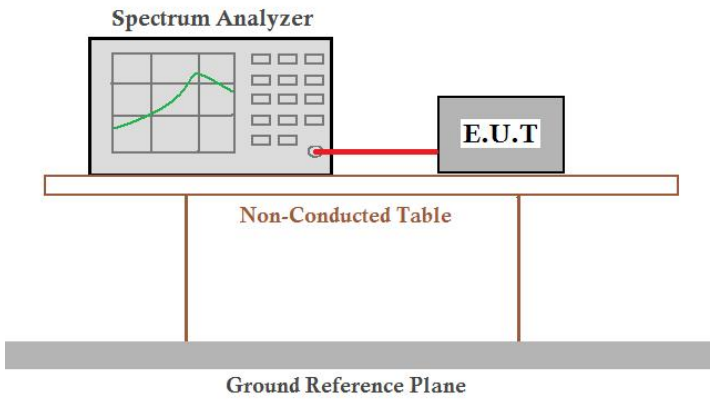
**Measurement Data: Please refer to Appendix II.**

## 6.2 Antenna Power

Test condition:	Test diffusion code and modulate with standard coding test signal
Test Procedure:	<p>a) The EUT is connected to the input port of the high frequency power meter through the attenuator and the transmit frequency is set.</p> <p>b) Remove the EUT and put the replacing signal generator (SG). Set the signal generator (SG) at same frequency and transmit on, the set SG output power at <math>P_t</math> to give the equivalent output level of "E".</p> <p>c) Calculate antenna power density by the formula below  <math>PD = P_t + 10 \cdot \log(1/x)</math>.</p> <p>x: The duty cycle of the EUT in continuously transmitting mode  <math>P_t</math>: Output power of the SG</p> <p>1. d) Antenna Power Error is definition that actual measure antenna power tolerance between +20% to -80% power range that base on manufacturer declare the conducted power density.</p>
Limit:	<p>Antenna power:</p> <p>Fibre-glass epoxy antenna</p> <p>1.4MHz: QPSK: 5.1mW/MHz, 16QAM: 4.9mW/MHz for MIMO</p> <p>10MHz: QPSK: 5.1mW/MHz, 16QAM: 5.2mW/MHz for MIMO</p> <p>20MHz: QPSK: 5.1mW/MHz, 16QAM: 5.1mW/MHz for MIMO</p> <p>Integral antenna</p> <p>1.4MHz: QPSK: 6.9mW/MHz, 16QAM: 6.6mW/MHz for MIMO</p> <p>10MHz: QPSK: 7.0mW/MHz, 16QAM: 7.0mW/MHz for MIMO</p> <p>20MHz: QPSK: 6.9mW/MHz, 16QAM: 6.0mW/MHz for MIMO</p> <p>EIRP: 12.14dBm/MHz</p>
Test setup:	
Test Instruments:	Refer to section 5.7 for details
Test results:	Pass

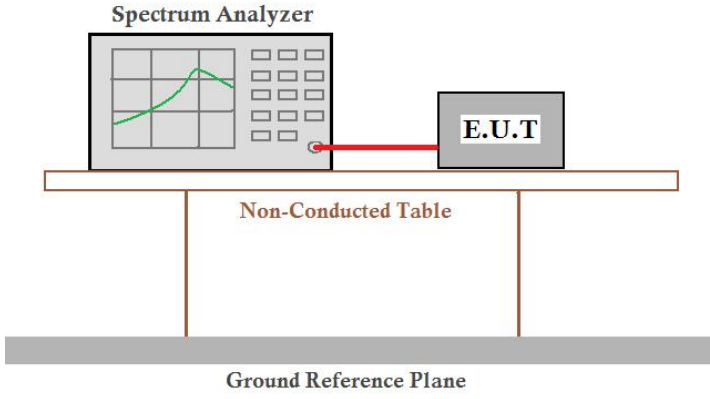
**Measurement Data: Please refer to Appendix II.**

### 6.3 Occupy Bandwidth (99%)

Test condition:	Test diffusion code and modulate with standard coding test signal
Spectrum set:	Test Frequency: test channel, RBW=VBW=30KHz, Span=3MHz, Sweep time=Auto, Detector mode=Positive peak
Limit:	26MHz or less
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test mode:	Transmitting mode
Test results:	Pass

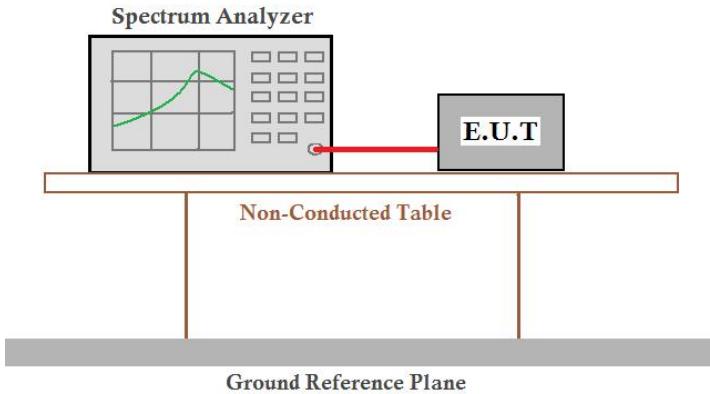
**Measurement Data: Please refer to Appendix II.**

#### 6.4 Spread spectrum bandwidth (90%)

Test condition:	Test diffusion code and modulate with standard coding test signal
Spectrum set:	Test Frequency: test channel, RBW=VBW=300KHz, Span=1.5*OBW, Sweep time=Auto, Detector mode=Positive peak
Limit:	500KHz or more
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an Equipment Under Test (E.U.T.). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test results:	Pass

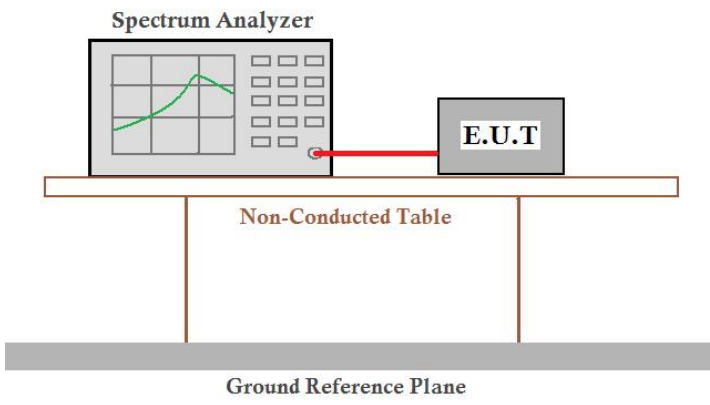
**Measurement Data: Please refer to Appendix II.**

## 6.5 Spurious emission intensity

Test condition:	Test diffusion code and modulate with standard coding test signal
Measurement procedure:	<b>Step 1</b> All spurious are measured from 10MHz to 13GHz by peak mode. <b>Step 2</b> If the value measured by Step1 is 3dB or less to the limit, measure in average mode.
Spectrum set:	<b>Step 1:</b> Test Frequency: test channel, Below 1GHz RBW=VBW=100kHz, Above 1GHz RBW=VBW=1MHz, Sweep time=Auto, Detector mode=Positive peak <b>Step 2:</b> Test Frequency: spurious frequency RBW=VBW=1MHz, Sweep time=Auto, Detector mode=Sample, Span=0Hz
Limit:	Below 2387 MHz: 2.5 $\mu$ W/MHz or less 2387 to 2400 MHz: 25 $\mu$ W/MHz or less 2483.5 through 2496.5 MHz: 25 $\mu$ W/MHz or less Over 2496.5 MHz: 2.5 $\mu$ W/MHz or less STD-T33 a. 2,458MHz $\leq f \leq$ 2,471MHz and 2,497MHz $< f \leq$ 2,510MHz 25 $\mu$ W or less b. 2,458MHz $> f$ and 2,510MHz $< f$ 2.5 $\mu$ W or less
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test results:	Pass

**Measurement Data: Please refer to Appendix II.**

## 6.6 Secondary radiated emissions

Test condition:	Receiving mode
Measurement procedure:	<b>Step 1</b> All spurious are measured from 10MHz to 13GHz by peak mode. <b>Step 2</b> If the value measured by Step1 is 3dB or less to the limit, measure in average mode.
Spectrum set:	<b>Step 1:</b> Test Frequency: test channel, Below 1GHz, RBW=VBW=100KHz; Above 1GHz, RBW=VBW=1MHz, Sweep time=Auto, Detector mode=Positive peak <b>Step 2:</b> Test Frequency: spurious frequency Test Frequency: test channel, Below 1GHz, RBW=VBW=100KHz; Above 1GHz, RBW=VBW=1MHz, Sweep time=Auto, Detector mode=Sample, Span=0Hz
Limit:	Below 1GHz: 4.0nW or less Above 1GHz: 20nW or less
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 5.7 for details
Test results:	Pass

**Measurement Data: Please refer to Appendix II.**

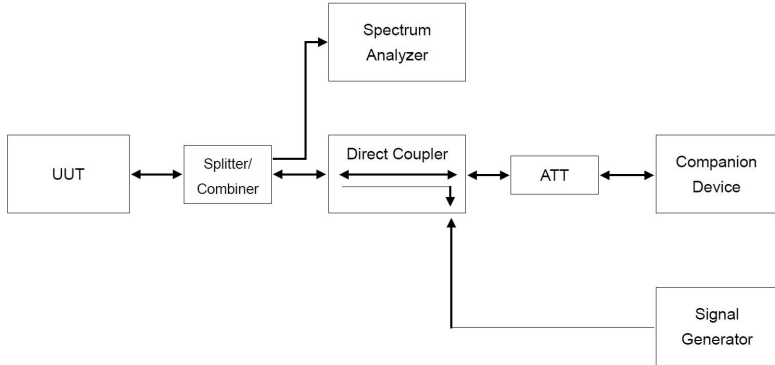
## 6.7 Interference suppression

Measurement procedure:	(1) The radio equipment with automatic transmitting function of identification code a) Transmit the assigned identification code from the radio equipment. b) Confirm the identification code received by the demodulator. (2) The radio equipment with automatic receiving function of identification code a) Transmit the assigned identification code from the opposite equipment. b) Confirm that the usual communication is available. c) Transmit the identification code distinct from the assigned one from the opposite equipment. d) Confirm that the radio equipment is stopped or an indication is displayed as the identification code is different.		
Test setup:	Radio equipment	Dummy load Attenuator)	Demodulator
Test Instruments:	Refer to section 5.7 for details		
Test results:	Pass		

### Measurement data:

Identification function:	Good MAC Address is 1A-6E-CF-6A-58-3B.
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## 6.8 Carrier Sense Capability

Limit:	Stop transmission for interference signal level above 100mV/m (or level at $22.79 + Gr - 20 \cdot \log(f)$ [dBm]) f: indicated frequency in MHz Gr: indicated the antenna gain in dBi	
Spectrum set:	Attenuation	Auto
	RBW/VBW	1MHz/1MHz
	Span	0Hz
	Sweep time	10s
	Detector	Peak
	Trigger mode	Free Run
Measurement procedure:	1. SG adjusted the frequency as same as the EUT transmitted signal and emitted the absence of modulation from SG. Then turn off the RF signal of SG. 2. EUT have transmitted the maximum modulation signal and fixed channelize. 3. Set the Spectrum per the above form. 4. SG RF signal on, and adjust the signal level until the EUT stop transmission at the tested frequency. Record the signal level. 5. EUT shall be stop the transmission and SG RF signal off. Then EUT will be continuously transmitted signal.	
Test setup:	 <pre> graph LR     UUT[UUT] &lt;--&gt; SC[Splitter/Combiner]     SC &lt;--&gt; DC[Direct Coupler]     DC --&gt; SA[Spectrum Analyzer]     DC &lt;--&gt; ATT[ATT]     ATT &lt;--&gt; CD[Companion Device]     SG[Signal Generator] --&gt; DC           </pre>	
Test Instruments:	Refer to section 5.7 for details	
Test results:	Pass	



## 7 Test Setup Photo

Reference to the **appendix I** for details

## 8 EUT Constructional Details

Reference to the **appendix II** for details

-----End-----